

# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC2250 SERIES

### LOW-SATURATED STABILIZED POWER SUPPLY WITH SYSTEM RESET PIN

#### DESCRIPTION

The  $\mu$ PC2250 series is a collection of low-saturated 4-pin stabilized power supplies with a pin that outputs a reset signal when a drop in the input voltage is detected.

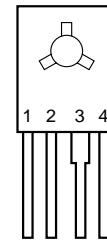
Because the reverse leakage current of these power supplies is about 1  $\mu$ A even if a voltage is applied to the output pin when the input voltage is cut off, these power supplies are ideal for systems with on-board microprocessors requiring battery backup.

#### FEATURES

- Low minimum voltage difference between input and output  
 $V_{DIF} = 0.15 \text{ V TYP. (at } I_o = 40 \text{ mA)}$
- Outputs reset signal (active-low) when the input voltage or output voltage drops.
- Low reverse leakage current during back up  
 $I_{OLK} = 1 \mu\text{A TYP.}$
- Low circuit operating current under no load  
 $I_{BIAS} = 1.3 \text{ mA TYP.}$

#### PIN CONFIGURATION (Marking Side)

4-pin plastic SIP (TO-126)  
 $\mu$ PC2251H, 2253H, 2255H

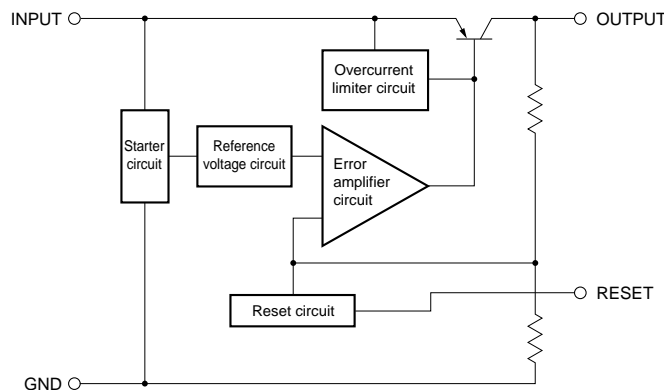


- 1: INPUT
- 2: RESET
- 3: GND
- 4: OUTPUT

#### ORDERING INFORMATION

Part Number	Package	Output Voltage
$\mu$ PC2251H	4-pin plastic SIP (TO-126)	3 V
$\mu$ PC2253H	4-pin plastic SIP (TO-126)	5 V (TYPE1)
$\mu$ PC2255H	4-pin plastic SIP (TO-126)	5 V (TYPE2)

#### BLOCK DIAGRAM



The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.  
 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

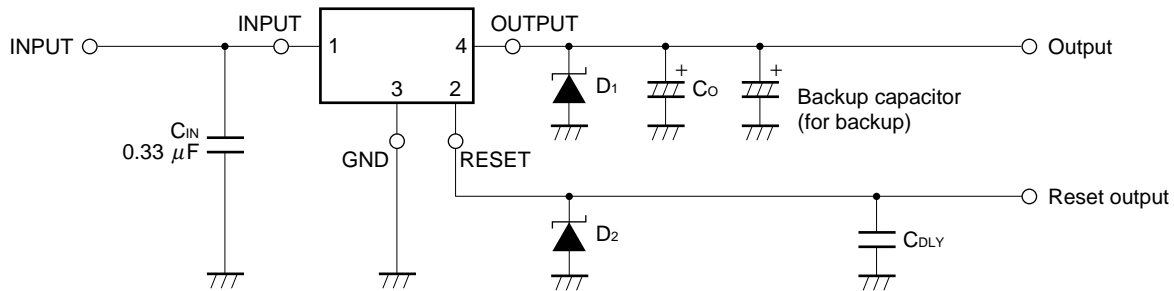
**ABSOLUTE MAXIMUM RATINGS (Unless otherwise specified, T<sub>A</sub> = 25°C)**

Parameter	Symbol	Rating	Unit
Input Voltage	V <sub>IN</sub>	-0.3 to +12	V
Total Power Dissipation	P <sub>T</sub>	1.2 <sup>Note</sup>	W
Operating Ambient Temperature	T <sub>A</sub>	-20 to +85	°C
Operating Junction Temperature	T <sub>J</sub>	-20 to +150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Thermal Resistance (Junction to Case)	R <sub>th(J-C)</sub>	10	°C/W
Thermal Resistance (Junction to Ambient)	R <sub>th(J-A)</sub>	104	°C/W

**Note** The total loss is limited by an internal circuit. Where T<sub>J</sub> > 150°C, an internal protection circuit cuts off the output.

**Caution** If any of the parameters exceeds the absolute maximum ratings, even momentarily, the quality of the product may be impaired. The absolute maximum ratings are values that may physically damage the product(s). Be sure to use the product(s) within the ratings.

**STANDARD CONNECTION**



- C<sub>IN</sub> : Determine the capacitance depending on the line between the power supply smoothing circuit and input pin. Be sure to connect this capacitor to prevent abnormal oscillation. Use of a capacitor, such as a film capacitor, with excellent voltage and temperature characteristics is recommended. Note that some laminated ceramic capacitors have poor temperature and voltage characteristics. When using a laminated ceramic capacitor, the capacitance must be stable in the voltage and temperature ranges used.
- C<sub>O</sub> : Must be 10 μF or more. Be sure to connect this capacitor to prevent oscillation and to improve transient load stability.  
Connect C<sub>IN</sub> and C<sub>O</sub> as close to the IC (within 1 to 2 cm) as possible.
- D<sub>1</sub>, D<sub>2</sub> : Connect Schottky barrier diodes (with a low forward voltage) if the voltage on the OUTPUT and RESET pins is lower than that on the GND pin.

μPC2251

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Input Voltage	$V_{IN}$	3.5	4	9	V
Output Current	$I_o$	0		40	mA
Operating Junction Temperature	$T_J$	-20		+125	°C

**Caution** The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute maximum ratings is small, and therefore thorough evaluation is necessary. The recommended operating conditions do not imply that the device can be used with all values at their maximum values.

ELECTRICAL SPECIFICATIONS

(Unless otherwise specified,  $V_{IN} = 4\text{ V}$ ,  $I_o = 40\text{ mA}$ ,  $T_J = 25^\circ\text{C}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_o = 10\text{ }\mu\text{F}$ .)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_{O1}$		2.88	3.00	3.12	V
	$V_{O2}$	$3.5\text{ V} \leq V_{IN} \leq 9\text{ V}$ , $1\text{ mA} \leq I_o \leq 40\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	2.85		3.15	V
Line Regulation	$REG_{IN}$	$3.5\text{ V} \leq V_{IN} \leq 12\text{ V}$			50	mV
		$3.5\text{ V} \leq V_{IN} \leq 9\text{ V}$			20	mV
Load Regulation	$REG_L$	$1\text{ mA} \leq I_o \leq 100\text{ mA}$			50	mV
		$1\text{ mA} \leq I_o \leq 40\text{ mA}$			20	mV
Quiescent Current	$I_{BIAS}$	$I_o = 0\text{ A}$			2.0	mA
		$I_o = 100\text{ mA}$		8.0		mA
Quiescent Current Change	$\Delta I_{BIAS}$	$4\text{ V} \leq V_{IN} \leq 12\text{ V}$			1.0	mA
Output Noise Voltage	$V_n$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		70		$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \bullet R$	$f = 120\text{ Hz}$ , $4\text{ V} \leq V_{IN} \leq 9\text{ V}$	48			dB
Dropout Voltage	$V_{DIF}$	$I_o = 40\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.15	0.30	V
Short Circuit Current	$I_{Oshort}$	$V_{IN} = 12\text{ V}$		15		mA
Peak Output Current	$I_{Opeak}$	$V_{IN} = 4\text{ V}$		150		mA
Temperature Coefficient of Output Voltage	$\Delta V_o/\Delta T$	$I_o = 5\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.2		mV/°C
OFF Output Leakage Current	$I_{OLK}$	$V_{IN} = 0\text{ V}$ , $V_o = 3.0\text{ V}$			10	$\mu\text{A}$
Reset Start Output Voltage	$V_{ORT}$	$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	$V_{O1}-0.2$		$V_{O1}-0.1$	V
Reset Output Saturated Voltage	$V_{RT(sat)}$	$I_R = 1.6\text{ mA}$			0.8	V

μPC2253

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Input Voltage	V <sub>IN</sub>	5.5	6	12	V
Output Current	I <sub>o</sub>	0		40	mA
Operating Junction Temperature	T <sub>J</sub>	-20		+125	°C

**Caution** The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute maximum ratings is small, and therefore thorough evaluation is necessary. The recommended operating conditions do not imply that the device can be used with all values at their maximum values.

ELECTRICAL SPECIFICATIONS

(Unless otherwise specified, V<sub>IN</sub> = 6 V, I<sub>o</sub> = 40 mA, T<sub>J</sub> = 25°C, C<sub>IN</sub> = 0.33 μF, C<sub>o</sub> = 10 μF.)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	V <sub>O1</sub>		4.8	5.0	5.2	V
	V <sub>O2</sub>	5.5 V ≤ V <sub>IN</sub> ≤ 12 V, 1 mA ≤ I <sub>o</sub> ≤ 40 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C	4.75		5.25	V
Line Regulation	REG <sub>IN</sub>	5.5 V ≤ V <sub>IN</sub> ≤ 12 V			30	mV
Load Regulation	REG <sub>L</sub>	1 mA ≤ I <sub>o</sub> ≤ 100 mA			80	mV
		1 mA ≤ I <sub>o</sub> ≤ 40 mA			30	mV
Quiescent Current	I <sub>BIAS</sub>	I <sub>o</sub> = 0 A			2.0	mA
		I <sub>o</sub> = 100 mA		8.0		mA
Quiescent Current Change	ΔI <sub>BIAS</sub>	6 V ≤ V <sub>IN</sub> ≤ 12 V			1.0	mA
Output Noise Voltage	V <sub>n</sub>	10 Hz ≤ f ≤ 100 kHz		130		μV <sub>r.m.s.</sub>
Ripple Rejection	R•R	f = 120 Hz, 6 V ≤ V <sub>IN</sub> ≤ 11 V	46			dB
Dropout Voltage	V <sub>DIF</sub>	I <sub>o</sub> = 40 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C		0.15	0.30	V
Short Circuit Current	I <sub>Oshort</sub>	V <sub>IN</sub> = 12 V		15		mA
Peak Output Current	I <sub>Opeak</sub>	V <sub>IN</sub> = 6 V		150		mA
Temperature Coefficient of Output Voltage	ΔV <sub>o</sub> /ΔT	I <sub>o</sub> = 5 mA, 0°C ≤ T <sub>J</sub> ≤ 125°C		0.3		mV/°C
OFF Output Leakage Current	I <sub>OLK</sub>	V <sub>IN</sub> = 0 V, V <sub>o</sub> = 5.0 V			10	μA
Reset Start Output Voltage	V <sub>ORT</sub>	0°C ≤ T <sub>J</sub> ≤ 125°C	2.70	2.85	3.00	V
Reset Output Saturated Voltage	V <sub>RT(sat)</sub>	I <sub>R</sub> = 1.6 mA			0.8	V

μPC2255

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Input Voltage	$V_{IN}$	5.5	6	12	V
Output Current	$I_o$	0		40	mA
Operating Junction Temperature	$T_J$	-20		+125	°C

**Caution** The recommended operating range may be exceeded without causing any problems provided that the absolute maximum ratings are not exceeded. However, if the device is operated in a way that exceeds the recommended operating conditions, the margin between the actual conditions of use and the absolute maximum ratings is small, and therefore thorough evaluation is necessary. The recommended operating conditions do not imply that the device can be used with all values at their maximum values.

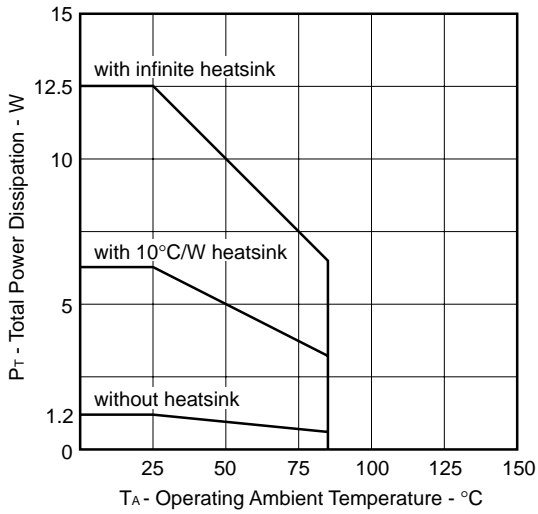
ELECTRICAL SPECIFICATIONS

(Unless otherwise specified,  $V_{IN} = 6\text{ V}$ ,  $I_o = 40\text{ mA}$ ,  $T_J = 25^\circ\text{C}$ ,  $C_{IN} = 0.33\text{ }\mu\text{F}$ ,  $C_o = 10\text{ }\mu\text{F}$ .)

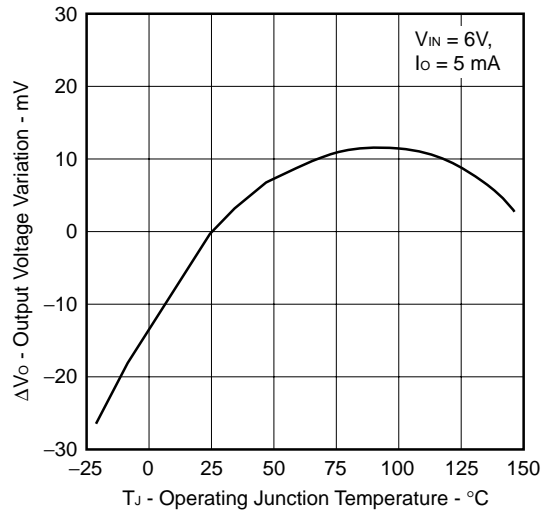
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Output Voltage	$V_{O1}$		4.8	5.0	5.2	V
	$V_{O2}$	$5.5\text{ V} \leq V_{IN} \leq 12\text{ V}$ , $1\text{ mA} \leq I_o \leq 40\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	4.75		5.25	V
Line Regulation	$REG_{IN}$	$5.5\text{ V} \leq V_{IN} \leq 12\text{ V}$			30	mV
Load Regulation	$REG_L$	$1\text{ mA} \leq I_o \leq 100\text{ mA}$			80	mV
		$1\text{ mA} \leq I_o \leq 40\text{ mA}$			30	mV
Quiescent Current	$I_{BIAS}$	$I_o = 0\text{ A}$			2.0	mA
		$I_o = 100\text{ mA}$		8.0		mA
Quiescent Current Change	$\Delta I_{BIAS}$	$6\text{ V} \leq V_{IN} \leq 12\text{ V}$			1.0	mA
Output Noise Voltage	$V_n$	$10\text{ Hz} \leq f \leq 100\text{ kHz}$		130		$\mu\text{V}_{r.m.s.}$
Ripple Rejection	$R \bullet R$	$f = 120\text{ Hz}$ , $6\text{ V} \leq V_{IN} \leq 11\text{ V}$	46			dB
Dropout Voltage	$V_{DIF}$	$I_o = 40\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.15	0.30	V
Short Circuit Current	$I_{Oshort}$	$V_{IN} = 12\text{ V}$		15		mA
Peak Output Current	$I_{Opeak}$	$V_{IN} = 6\text{ V}$		150		mA
Temperature Coefficient of Output Voltage	$\Delta V_o / \Delta T$	$I_o = 5\text{ mA}$ , $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$		0.3		mV/°C
OFF Output Leakage Current	$I_{OLK}$	$V_{IN} = 0\text{ V}$ , $V_o = 5.0\text{ V}$			10	$\mu\text{A}$
Reset Start Output Voltage	$V_{ORT}$	$0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$	$V_{O1} - 0.3$		$V_{O1} - 0.2$	V
Reset Output Saturated Voltage	$V_{RT(sat)}$	$I_R = 1.6\text{ mA}$			0.8	V

CHARACTERISTIC CURVES (Unless otherwise specified,  $T_A = 25^\circ\text{C}$ . Reference values)

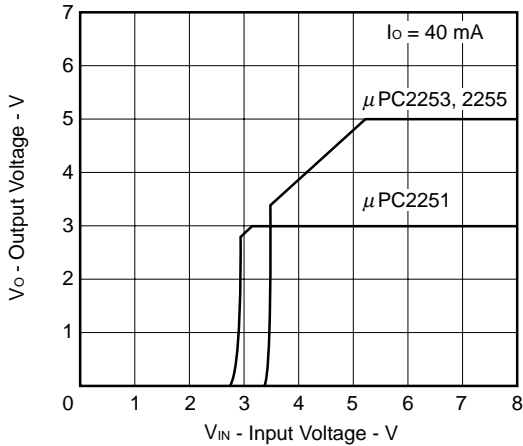
$P_T$  vs.  $T_A$  Characteristics



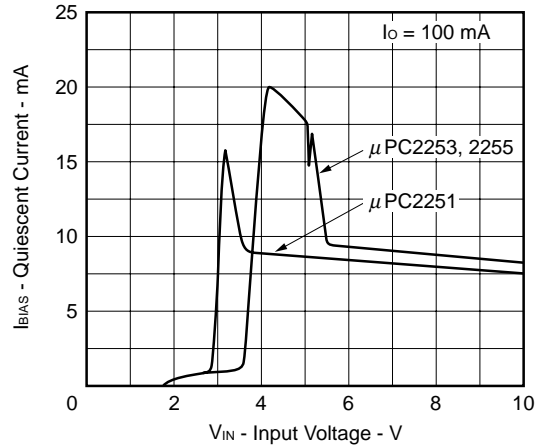
$\Delta V_o$  -  $T_J$  Characteristics



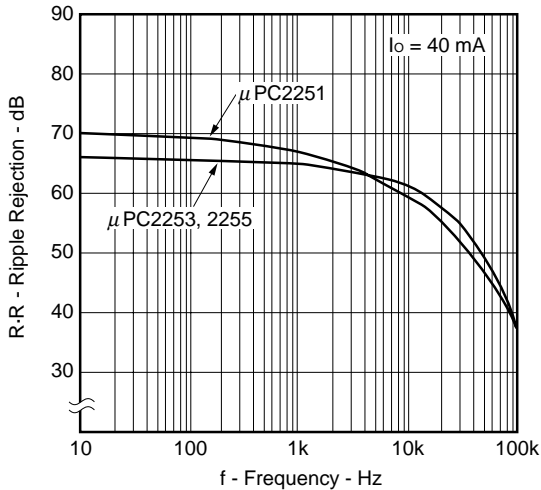
$V_o$  -  $V_{IN}$  Characteristics



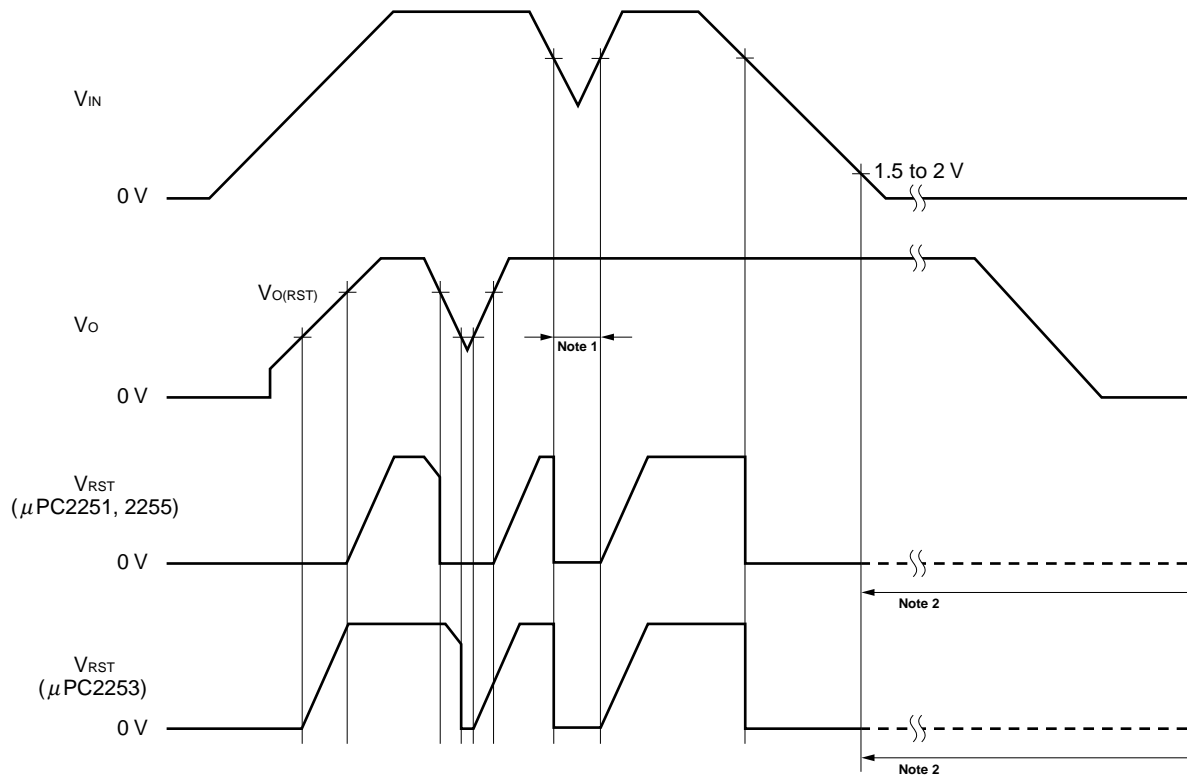
$I_{BIAS}$  -  $V_{IN}$  Characteristics



R·R - f Characteristics



RESET OUTPUT CHARACTERISTICS (with standard connection)



- Notes**
1. The reset signal is output if the circuit enters backup status when the input voltage falls below the output voltage.
  2. The reset output is undefined if the input voltage is 1.5 to 2 V or lower.

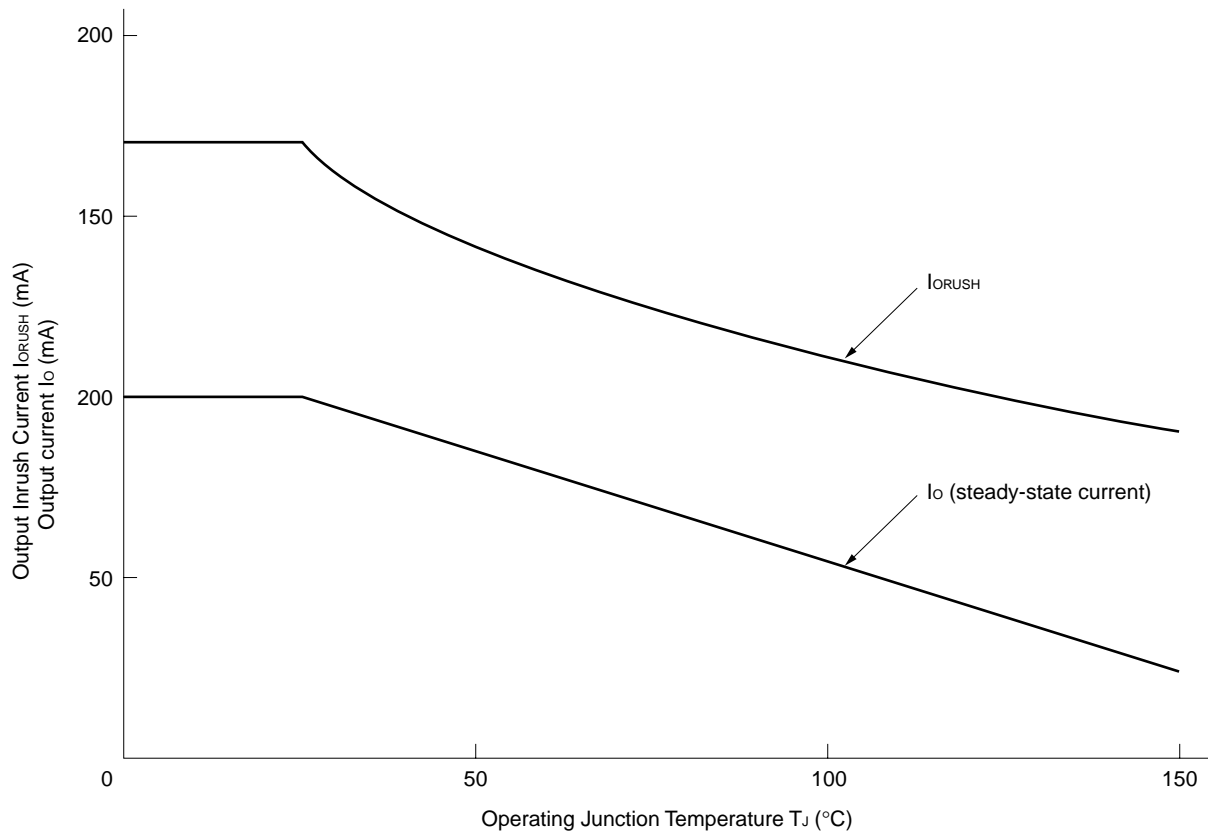
**NOTES ON CORRECT USE**

Keep the output current of the μPC2250 series to within  $I_o$  (steady-state current) in Figure 1 at the operating junction temperature ( $T_j$ ).

Keep the output current, including the inrush current to the output capacitor, to within  $I_{ORUSH}$  in the figure when starting the circuit.

If these current limits are exceeded, the output voltage may not rise to the specified level because of the operation of the overcurrent limiter circuit.

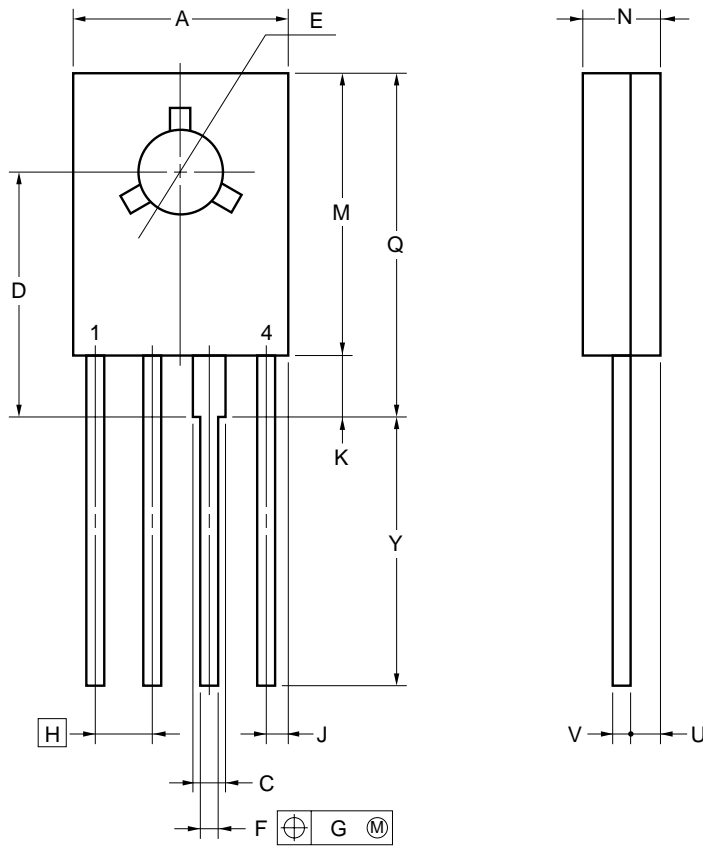
**Figure 1. Output Current Limits of μPC2250 Series**





PACKAGE DRAWINGS

4 PIN PLASTIC SIP (TO-126)



**NOTE**

Each lead centerline is located within 0.2 mm (0.008 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	8.5 MAX.	0.335 MAX.
C	1.1 MIN.	0.043 MIN.
D	9.7±0.3	0.382±0.012
E	φ3.2±0.1	φ0.126±0.004
F	0.65±0.1	0.026 <sup>+0.004</sup> <sub>-0.005</sub>
G	0.2	0.008
H	2.0	0.079
J	1.25 MAX.	0.05 MAX.
K	2.3 MIN.	0.09 MIN.
M	11.5 MAX.	0.453 MAX.
N	2.7±0.2	0.106 <sup>+0.009</sup> <sub>-0.008</sub>
Q	14.5 MAX.	0.571 MAX.
U	1.7 MAX.	0.067 MAX.
V	0.55±0.1	0.022 <sup>+0.004</sup> <sub>-0.005</sub>
Y	13.5±0.7	0.531 <sup>+0.029</sup> <sub>-0.028</sub>

P4HP-200B-1

**RECOMMENDED SOLDERING CONDITIONS**

Solder this product under the following recommended conditions.

For details of the recommended soldering conditions, refer to information document **Semiconductor Device Mounting Technology Manual (C10535E)**.

For soldering methods and conditions other than those recommended, consult NEC.

**Through Hole Type Soldering Conditions**

**μPC2251H, 2253H, 2255H: 4-pin plastic SIP (TO-126)**

Soldering Method	Soldering Conditions
Wave soldering (Pins only)	Solder bath temperature: 260°C max., Time: 10 sec max.
Partial heating	Pin temperature: 300°C max., Time: 3 sec max. (per pin)

**Caution** When soldering this product using wave soldering, exercise care that the solder does not come in direct contact with the package.

[MEMO]

- **The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.**
- No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.
- NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.
- Descriptions of circuits, software, and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software, and information in the design of the customer's equipment shall be done under the full responsibility of the customer. NEC Corporation assumes no responsibility for any losses incurred by the customer or third parties arising from the use of these circuits, software, and information.
- While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.
- NEC devices are classified into the following three quality grades:  
"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
  - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
  - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
  - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.